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EXAMINER
FETZNER, TIFFANY A

ART UNIT	PAPER NUMBER
2859	

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Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary

Application No.	Applicant(s)
09/541,354	Raphael Yair et al.,
Examiner	**Art Unit**
Tiffany Fetzner	2859

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136 (a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133).
- Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1) ☒ Responsive to communication(s) filed on *Jun 2, 2003* .

2a) ☒ This action is **FINAL**. 2b) ☐ This action is non-final.

3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11; 453 O.G. 213.

Disposition of Claims

4) ☒ Claim(s) *1-3, 5-23, and 25-28* is/are pending in the application.

4a) Of the above, claim(s) _____ is/are withdrawn from consideration.

5) ☐ Claim(s) _____ is/are allowed.

6) ☒ Claim(s) *1-3, 5-23, and 25-28* is/are rejected.

7) ☐ Claim(s) _____ is/are objected to.

8) ☐ Claims _____ are subject to restriction and/or election requirement.

Application Papers

9) ☐ The specification is objected to by the Examiner.

10) ☒ The drawing(s) filed on *Mar 31, 2000* is/are a) ☒ accepted or b) ☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

11) ☐ The proposed drawing correction filed on _____ is: a) ☐ approved b) ☐ disapproved by the Examiner.

If approved, corrected drawings are required in reply to this Office action.

12) ☐ The oath or declaration is objected to by the Examiner.

Priority under 35 U.S.C. §§ 119 and 120

13) ☐ Acknowledgement is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a) ☐ All b) ☐ Some* c) ☐ None of:

1. ☐ Certified copies of the priority documents have been received.
2. ☐ Certified copies of the priority documents have been received in Application No. _____ .
3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

*See the attached detailed Office action for a list of the certified copies not received.

14) ☐ Acknowledgement is made of a claim for domestic priority under 35 U.S.C. § 119(e).

a) ☐ The translation of the foreign language provisional application has been received.

15) ☐ Acknowledgement is made of a claim for domestic priority under 35 U.S.C. §§ 120 and/or 121.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☐ Information Disclosure Statement(s) (PTO-1449) Paper No(s). _____
4) ☐ Interview Summary (PTO-413) Paper No(s). _____
5) ☐ Notice of Informal Patent Application (PTO-152)
6) ☐ Other:

DETAILED Final ACTION

1. The examiner notes that **claims 4 and 24 are canceled** as per applicant's April 3rd 2002 response.

Drawings

2. The objection to Figure 8 is **rescinded** in view of applicant's remarks on page 6 paragraph 1 of the April 3rd 2002 response.

3. ***Response to Arguments***

4. Applicant's arguments with respect to **claims 1-3, 5-23,** and **25-28** from the June 23rd 2003 amendment response have been considered but are not persuasive.

A) Applicant argues on page 11 paragraph 3 through page 12 paragraph 2 that: the **Marcovski et al**., reference which controls the flow of current with switches, (i.e. this limitation is required by applicant's claim 1, because applicant claims "a switching circuit which linearly conducts current between a source and a load") is directed to a different issue. However, applicant's claim 1 is directed to just a switching circuit to conduct a current. Therefore any circuit which directs current linearly between a source and a load meets applicant's claim 1. The fact that the **Marcovski et al**., reference uses the **Marcovski et al**., switching circuit in MR cardiac imaging, fails to eliminate the **Marcovski et al**., reference as prior art, because the limitations claimed by applicant are still met by the reference. Applicant's argument is not persuasive.

B) Applicant argues on page 11 paragraph 3 through page 12 paragraph 2 that: the **Marcovski et al.**, reference fails to disclose a switching device having a "first phase of operation

dependent on the magnitude of the current applied to the load". However, **Marcovski et al.**, shows and teaches a switching device with a first phase (i.e. at least one switch in a first position until a specified set of conditions are met) and a second phase (i.e. at least one switch in a second position when a second set of conditions are met) that affects the inductive load component 11 because **Marcovski et al.**, teaches that the switches are activated or deactivated dependent upon the rate of change of current (i.e. di/dt) charging/discharging a capacitor, [See col. 4 line 1 through col. 6 line 11] and because the rate of change of current (i.e. di/dt) charging/discharging a capacitor is related to the current magnitude in the circuit containing the capacitor, depending on the situational positioning of the switches, the magnitude of the current passing through component 11 of Figure 3, (i.e. component 11 is interpreted as applicant's load) changes. Therefore, the magnitude of the current passing through component 11 is constant for a first position of the switches of Figure 4, and different for a second position of the switches of Figure 4, thus applicant's argument is not persuasive.

C) Applicant argues on page 13 paragraph 3 that: the **Van Groningen**, reference which minimizes current loss through switches is directed to a different issue, than applicant's invention. However, applicant's claim 1 is directed to just a switching circuit to conduct a current. Therefore the fact that the **Van Groningen**, reference uses the **Van Groningen**, switching circuit to resolve switching losses in MR amplifiers, fails to eliminate the **Van Groningen**, reference as prior art, because the limitations claimed by applicant are still met by the reference.

D) Applicant argues on page 11 paragraph 3 through page 15 paragraph 1 that: the **Van Groningen**, reference fails to disclose: A first phase of operation or a first portion that is

dependent on the magnitude of the current applied to the load or gradient coil assembly or a second switching device or current steering circuit having a second portion of current to the load or gradient coils being "below a non-zero threshold value". However, the **Van Groningen**, reference teaches that position of the switches in Figures 2, 3, and 4 are situational. In each situation there is effectively a different current through inductor 58 of figure 2. Additionally, because a different current flowing through an inductor produces a different magnitude of current, the circuitry structure shown by **Van Groningen**, also suggests via the teachings of col. 5 line 66 through col. 11 line 11, that the magnitude of the current applied to inductor 58 of figure 2 changes for each situation. Because, the inductive component 58 is also effectively a load within **Van Groningen's** circuity, through which current passes. Each of the positional switch situations is interpreted by the examiner as "A first phase of operation or a first portion" (i.e. a first set of switch positions) "that is dependent on the magnitude of the current applied to the load" (i.e. inductive component 58 of Figure 2) or gradient coil assembly". Additionally **Van Groningen** teaches "a second switching device" (i.e. See the components of Figure 2, specified in the rejection of **claim 1**) "or current steering circuit" " (i.e. See the components of Figure 2, specified in the rejection of **claim 1**) "having a second portion of current to the load" (i.e. a second configuration of switch positions, resulting in an alteration of current through the inductive load component 58) "or gradient coils being below a non-zero threshold value" [See col. 5 line 66 through col. 11 line 11 where the changing of the current below a value which satisfies a half-period is interpreted as "a non-zero-threshold value", and because the reference teaches the switching which occurs in each type of situation depends upon the amount of current through the

switch components, the applicant's argument on page 15 paragraph 1 stating that the **Van Groningen** reference is devoid of action which occurs when current through the load (i.e. interpreted by the examiner as inductive component 58) falls below "a non-zero-threshold value". is not persuasive.

E) Applicant's response to each of the 103 rejections, on pages 15 paragraph 3 through page 17 paragraph 2 is not persuasive because each of the argued responses merely recite that the 103 rejections are not proper because of the deficiencies in the **Van Groningen** reference. Because the argued deficiencies of **Van Groningen** are found within the **Van Groningen** reference. The 103 rejections are proper and the rejections are made final.

5. ***Claim Rejections - 35 USC § 102***

6. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

> A person shall be entitled to a patent unless --
>
> (b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.
>
> (e) the invention was described in (1) an application for patent, published under section 122(b), by another filed in the United States before the invention by the applicant for patent or (2) a patent granted on an application for patent by another filed in the United States before the invention by the applicant for patent, except that an international application filed under the treaty defined in section 351(a) shall have the effects for purposes of this subsection of an application filed in the United States only if the international application designated the United States and was published under Article 21(2) of such treaty in the English language.

7. **Amended Claim 1,** is **finally** rejected under **35 U.S.C. 102(b)** as being anticipated by **Macovski et al.**, US patent 5,835,995 issued November 10th 1998, filed October 28th 1996.

8. With respect to **Three times Amended Claim 1, Macovski et al.**, teaches, shows, and / or suggests "A switching circuit" [See Figures 3, where the switching circuit is considered to comprise switch/diode components 26, components 25, 22, and components 23, 24, and 21 taken as a combination together] "to linearly conduct current between a source" [See Figures 3 power supply 20]"and a load" [See Figure 3, component 11] **Macovski et al.**, teaches, shows, and / or suggests that "the circuit comprising: a switching device" [See Figure 3 switch component 26, and / or components 23, 24, and 21 taken as a combination together] "coupled between the source and the load", [See Figure 3]. **Macovski et al.**, also teaches, shows, and / or suggests that the switching device having a conductive state in which a first portion of the current is conducted between the source and the load during a first phase of operation, (i.e. the ramp up interval) "the first phase of operation dependent on the magnitude of the current applied to the load;" [See col. 4 line 1 through col. 6 line 11] "and a current steering circuit" [See Figure 4 and col. 4 lines 29-55 especially col. 4 lines 34-37 where **Macovski et al.**, explicitly teaches replacing component 25 in Figure 3 with the circuitry of Figure 4. The examiner notes that by making this substitution the **Macovski et al.**, reference suggests applicant's claimed circuit, because with this configuration the "steering circuit" (i.e. the components of Figure 4) are "coupled between the source" (i.e. component 20 of Figure 3) "and the load" (i.e. component 11 of figure 3) "and in parallel with the switching device", [See Figures 3 and 4 in combination] Additionally, **Macovski et al.**, teaches, shows, and / or suggests that "the current steering circuit" (i.e. the circuitry of Figure 4) "has a conductive state in which a second portion of the current is conducted between the source and the load during a second phase of operation" (i.e. the down ramping) "in which the magnitude of the

current applied to the load is below a non-zero threshold value." [See **Macovski et al.**, col. 4 line 1 through col. 6 line 11 where the examiner notes that the rate of change of the current di/dt, for charging/discharging capacitors 30 and 31, is related to the current magnitude containing the capacitive components 30, 31 and impacts inductive load component 11 . Additionally Figure 3, is taught to be modifiable by replacing capacitor 25 of Figure 3 with the circuitry of figure 4, as in col. 4 lines 34-37].

9. **Claims 1, 2, 3, 5, 6, 10-13, 18, 23, 25** and **28** are **finally** rejected under **35 U.S.C. 102(e)** as being anticipated by **Van Groningen**, US patent 6,140,873 issued October 31st 2000 with an effective filing date of July 28th 1999.

10. With respect to **Three times Amended Claim 1, Van Groningen**, teaches, shows, and / or suggests "A switching circuit" [See Figures 2, components 34-1, 34-2 through component 34-n; col. 6 line 1 through col. 7 line 15; Figure 3 switch components 36, 38, with diodes 40, 42, and capacitors 52, 54, and Figure 4 switch components 100-106, with diodes 110-116, and capacitors 120-126] "to linearly conduct current between a source" [See Figures 2, 3 and 4 component 50] "and a load" [See Figures 2 3, and 4 component 70; col. 6 line 1 through col. 8 line 58] **Van Groningen**, teaches, shows, and / or suggests that "the circuit comprising: a switching device" [See the switching IGBT type power transistors, or thyristors components 36, 38, in Figures 2; col. 6 lines 1-31] "coupled between the source and the load", [See Figures 2, 3, and 4]. **Van Groningen**, also teaches, shows, and / or suggests that the switching device having a conductive state in which a first portion of the current is conducted between the source and the load during a first phase of operation, the first phase of operation dependent on the magnitude of the current

applied to the load;" [See abstract, col. 2 line 62 through col. 5 line 10; col. 5 line 29 through col. 11 line 8 and the response to arguments given above.] "and a current steering circuit" [See Figure 2 components 60-2 with 64-2; or 60-3 with 64-3; or 60-1 with 64-1; Figure 3 circuit 72; Figure 4 circuit 80] "coupled between the source" (i.e. component 50) "and the load" (i.e. component 70) "and in parallel with the switching device", [See Figure 2] Additionally, **Van Groningen**, teaches, shows, and / or suggests that "the current steering circuit has a conductive state in which a second portion of the current is conducted between the source and the load during a second phase of operation in which the magnitude of the current applied to the load" (i.e. inductor component 58) "is below a non-zero threshold value." [See abstract, col. 2 line 62 through col. 5 line 10; col. 5 line 29 through col. 11 line 8 and the response to arguments given above.]

11. With respect to **Twice Amended Claim 10, Van Groningen**, teaches, shows, and / or suggests "A magnetic resonance imaging. (MRI) system to perform an MRI scan in accordance with a pulse sequence, the pulse sequence including at least a first pulse" [See col. 5 lines 29-48 where rf coil 9 serves to generate at least one alternating magnetic field, (i.e. the alternating magnetic field produced by coil 9 is considered by the examiner to be an equivalent term for an RF pulse). Additionally central control device 17 controls modulator 19 for rf source 11, with modulator 19 also controlled by RF oscillator 23 and these components are used to generate MRI pulse sequences; [See also col. 1 lines 18-29]]. **Van Groningen**, also teaches, shows, and / or suggests the "the system comprising: a gradient coil assembly to generate a gradient magnetic field during the MRI scan;" [See Figure 1 component 3 which shows the gradient coil system; col. 2 line 62 through col. 5 line 10; and col. 5 line 29 through col. 11 line 8] "an amplifier to drive the

gradient coil assembly such that the gradient coil assembly generates the gradient magnetic field in accordance with the pulse sequence" [See Figures 1, 2 component 7; col. 5 line 29 through col. 11 line 8]

12. The limitations of "a switch assembly to provide a conductive path between the amplifier and the gradient coil assembly, the switch assembly comprising: a first switching device having a conductive state during a first portion of the first pulse of the pulse sequence," for the same reasons given in the rejection of claim 1, which need not be reiterated. The amended feature of "the first portion dependent on the magnitude of a current applied to the gradient coil assembly"; is shown and taught by Figures 2 through 4 which show a power amplifier for a gradient coil system, (i.e. in the **Van Groningen**, reference the amplified current of component 7 affects the **Van Groningen**, gradient coil system shown as component 3) and the same arguments given in the response to arguments above, with figure 1 showing the amended structural components.

13. Additionally, **Van Groningen**, teaches a second switching device coupled in parallel with the first switching device, the second switching device having a conductive state during a second portion of the first pulse of the pulse sequence during which a current from the amplifier to the gradient coil assembly is below a non-zero threshold value" are taught suggested and shown by **Van Groningen**, for the same reasons given in the rejection of claim 1, which need not be reiterated. Additionally, **Van** Groningen, also teaches and shows that "the conductive path is provided between the amplifier and the gradient coil assembly during substantially the entire duration of the first pulse." [See col. 2 line 62 through col. 11 line 8; especially col. 3 line 62

through col. 5 line 10.] The same reasons for rejection, that apply to **claim 1,** also apply to **claim 10**.

14. With respect to **Amended Claim 18,** and corresponding method **claim 23**, **Van Groningen**, suggests and shows "A magnetic resonance imaging (MRI) system for acquiring MRI data, the system comprising: a processor" (central control device 17) "to control acquisition of the MRI data in accordance with a program stored in a memory, the program including an imaging protocol having a sequence of gradient pulses and a sequence of detection pulses" [See abstract, Figure 1, col. 2 line 62 through col. 11 line 8.] **Van Groningen**, also teaches, suggests and shows "a gradient amplifier to drive the gradient coil assembly in accordance with the sequence of gradient pulses;" [See Figures 1, 2 component 7; col. 5 line 29 through col. 11 line 8] "an MRI scanner to perform an MRI scan in accordance with the stored imaging protocol", [See Figure 1, col. 5 lines 29-65; and col. 2 line 62 through col. 11 line 8 as **Van Groningen**, invention is taught and described in connection with an MRI apparatus.] **Van Groningen**, shows and suggests that "the MRI scanner comprising a magnet;.a gradient coil assembly, and an RF coil assembly" [See Figure 1, col. 5 lines 29-65] **Van Groningen**, also teaches, suggests and shows "an RF detector coupled to the RF coil to detect MRI data resulting from the MRI scan in accordance with the sequence of detection pulses" [See Figure 1 col. 2 line 62 through col. 11 line 8]

15. The limitations of a "gradient coil assembly generating a gradient magnetic field in accordance with the sequence of pulses; a switch assembly coupled between the gradient amplifier and the gradient coil assembly to provide a conductive path therebetween, the switch assembly

comprising: a first switching device having a conductive state during a first portion of a first gradient pulse," for the same reasons given in the rejection of claim 1, which need not be reiterated. The amended feature of "the first portion dependent on the magnitude of a current applied to the gradient coil assembly"; is shown and taught by Figures 2 through 4 which show a power amplifier for a gradient coil system, (i.e. in the **Van Groningen**, reference the amplified current of component 7 affects the **Van Groningen**, gradient coil system shown as component 3) and the same arguments given in the response to arguments concerning the **Van Groningen**, reference, with figure 1 showing the amended structural components.

16. The features of a second switching device coupled in parallel with the first switching device, the second switching device having a conductive state during a second portion of the first gradient pulse during which a current from the amplifier to the gradient coil assembly is below a non-zero threshold value, wherein the conductive path is provided between the gradient amplifier and the gradient coil assembly during substantially the entire duration of the first pulse;" are taught and shown by **Van Groningen**, for the same reasons given in the rejection of **claims 1**, and **10**, which need not be reiterated. The same reasons for rejection, that apply to **claims 1,** and **10** also apply to **claim 18,** and **corresponding method claim 23**.

17. With respect to **Claim 2**, **Van Groningen**, teaches and shows that "the switching device" (i.e. IGBT type controllable switch components 36 and 38) "are in a non-conductive state during the second phase of operation." [See col. 8 line 37 trough col. 11 line 8; Figures 1, 2, 3, and 4, where the numerous component arrangements for switching to occur from conductive to non-conductive states, or non-conductive to conductive states are explained in detail.] The examiner

notes that "on" or "off" suggest conduction or non-conduction as taught in the reference.] The same reasons for rejection, that apply to **claim 1** also apply to **claim 2**.

18. With respect to **Claim 3**, **Van Groningen**, teaches, shows and shows that "the current steering circuit" [See Figure 2 components 60-2 with 64-2; or 60-3 with 64-3; or 60-1 with 64-1; col. 6 line 44 through col. 7 line 22; Figure 3 circuit 72; col. 7 line 23 through col. 9 line 41; Figure 4 circuit 82; col. 9 line 42 through col. 11 line 8] "is in a non-conductive state during at least one phase of operation." [See col. 5 line 66 through col. 11 line 8, where the numerous component arrangements for switching to occur from conductive to non-conductive states, or non-conductive to conductive states are explained in detail.] The same reasons for rejection, that apply to **claim 1** also apply to **claim 3**.

19. With respect to **Claim 5**, **Van Groningen**, teaches and shows that "the second phase of operation occurs when the switching device" [See components 36 and 38 in Figure 2] "transitions from the conductive state to a non-conductive state." [See col. 5 line 66 through col. 11 line 8, where the numerous component arrangements for switching to occur from conductive to non-conductive states, or non-conductive to conductive states are explained in detail.] The same reasons for rejection, that apply to **claims 1, 2** also apply to **claim 5**.

20. With respect to **Claim 6**, **Van Groningen**, teaches and shows that "the switching device" [See components 36i-n and 38i-n in Figure 2] "transitions from the conductive state to a non-conductive state when the absolute value of the magnitude of the current falls below a non-zero threshold value." [See situation II col. 8 line 36 through col. 9 line 14] The same reasons for rejection, that apply to **claim 1** also apply to **claim 6**.

21. With respect to **Claim 11**, **Van Groningen**, teaches and shows that "the first portion of the first pulse of the pulse sequence" (i.e. the rise time) "is dependent on the magnitude of current conducted through the first switching device." [See Figures 1, 2, 3, 4, col. 1 lines 13-55 where current pulse having a rise time magnitude of 0.2 ms and a pulse length of 1-10ms are taught, and situation II col. 8 line 36 through col. 9 line 14] The same reasons for rejection, that apply to **claims 1, 5, 6,** and **10** also apply to **claim 11**.

22. With respect to **Claim 12**, the examiner notes that this limitation is already an aspect of independent claim 10, therefore **Van Groningen**, teaches, and shows that "the second portion of the first pulse occurs when the magnitude of the current conducted through the first switching device reaches a non-zero threshold value", for the same rejection reasons given in the rejection of **claim 10** that need not be reiterated. Additionally, See situation II col. 8 line 36 through col. 9 line 14. The same reasons for rejection, that apply to **claims 1, 5, 6, 10** and **11** also apply to **claim 12**.

23. With respect to **Claim 13**, the **Van Groningen**, reference shows and shows that the "first switching device and the second switching device are uni-directional current-conducting devices, each of the first and second switching devices conducting current in the same direction.[See Figures 1-4 components 38i-38n which conduct current in the same direction; or components 36i-36n which conduct current in the same direction; or their corresponding transistor components in Figures 3 and 4; or the IGBT taught in col. 6 lines 9-13; or the transistors which are connected in series, such that a current through the transistor components, is directed in one direction.] The **Van Groningen**, reference teaches and shows that the conductive direction is "between the

amplifier and the gradient coil assembly", as mentioned in the rejection of **claim 10**, and taught in col. 5 line 66 through col. 6 line 17. The same reasons for rejection, that apply to **claims 1, 4, 5, 6,** and **10** also apply to **claim 13**.

24. With respect to **Claim 25**, This claim is just the method version of **claims 1, 5, 10,** and **18** combined. Therefore, The same reasons for rejection that apply to **claims 1, 4, 10, 18,** and **23** also apply to **claim 24** and need not be reiterated.

25. With respect to **Claim 28**, The **Van Groningen**, reference teaches and shows "generating MRI data as a result of the MRI scan; and detecting the MRI data" [See col. 5 lines 29-48] The same reasons for rejection, that apply to **claims 1, 10, 18,** and **23** also apply to **claim 28** and need not be reiterated.

26. ***Claim Rejections - 35 USC § 103***

27. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

28. The factual inquiries set forth in *Graham* **v.** *John Deere Co.*, 383 U.S. 1, 148 USPQ 459 (1966), that are applied for establishing a background for determining obviousness under 35 U.S.C. 103(a) are summarized as follows:

1. Determining the scope and contents of the prior art.
2. Ascertaining the differences between the prior art and the claims at issue.
3. Resolving the level of ordinary skill in the pertinent art.

4. Considering objective evidence present in the application indicating obviousness or nonobviousness.

29. **Claims 7, 8, 9, 14, 15, 19** are **finally** rejected under 35 U.S.C. 103(a) as being unpatentable over **Van Groningen**, US patent 6,140,873 issued October 31st 2000 with an effective filing date of July 28th 1999 as applied to **claims 1, 10, 18** above ; and in further view of alternatively **Mansfield et al.**, US patent 4,820,986 issued April 11th 1989; or **Macovski et al.**, US patent 5,835,995 issued November 10th 1998; filed October 28th 1996.

30. With respect to **Claim 7**, **corresponding claim 14** which depends from **independent claim 10** and **corresponding claim 19** which depends from **independent claim 18; Van Groningen**, lacks directly teaching that "the switching device comprises a silicon controlled rectifier (SCR)." However, **Mansfield et al.**, teaches that in an MRI apparatus with four switches that are each shunted by diodes so that current can flow in either direction through a coil depending on the setting of the switches, that the switches can be FET's, SCR's, bidirectional solid-state devices or bidirectional mechanical devices. [See col. 7 lines 14-20; col. 7 lines 55-60; col. 1 lines 4-30; the abstract] Additionally, **Macovski et al.**, teaches and suggests that "the switching device comprises a silicon controlled rectifier (SCR)." because **Macovski et al.**, teaches that the switches of Figures 3 and 4 in reality are electronic switches such as SCR's (silicon controlled rectifiers), thyristors or comparable high power devices that are actuated by a pre-set computer program as in all MRI systems used today. [See col. 4 lines 50-55; col. 5 lines 4-19 and Figures 3-5]

31. It would have been obvious to one of ordinary skill in the art, at the time that the invention was made that the **Van** Groningen, gradient amplifier can be modified to include the silicon controlled rectifiers (SCR)'s of **Mansfield et al.**, or **Macovski et al.**, because the **Van Groningen**, apparatus shows, teaches and suggests that the multiple switches of the **Van Groningen**, invention (i.e. shown in Figures 2, 3, and 4 of **Van Groningen**,) are controllable electronically by central control device 17 of figure 1. [See col. 5 lines 42-46 with each switch shunted by a diodes so that current flows in a direction which depends on the setting of the switches, **Van Groningen**, Figures 2, 3, 4, and col. 5 line 29 through col. 11 line 17], Because the **Van Groningen**, reference requires controlled switches, the substitution of the SCR switches is an obvious modification to the **Van Groningen**, reference that is directly suggested from the use of the silicon controlled rectifier switches, which are computer controlled in the **Macovski et al.**, reference, or controlled by the state of the switches as in the **Mansfield et al.**, reference. The ability and motivation to combine these references comes from the fact that both references concern the ability to control the current and magnetic gradients, in NMR and MRI systems; and both references use the same basic configuration, to address and control the highly switched current required in an NMR / MRI system. The same reasons for rejection, obviousness, and motivation to combine, that apply to **claims 1, 10, 18,** also apply to **claims 7, 14, 19**.

32. With respect to **Claim 8**, and **corresponding claim 15** which depends from **independent claim 10, Van Groningen**, teaches, shows and suggests that the "steering circuit comprises a transistor to conduct the current during the second phase of operation." [See Figures 2, 3, 4 and

col. 5 line 29 through col. 9 line 20.] The same reasons for rejection, obviousness, and motivation to combine that apply to **claims 1, 7, 10** also apply to **claims 8, 15**.

33. With respect to **Claim 9**, **Van Groningen**, suggests and shows that the "switching device comprises a pair of anti-parallel" transistors [See Figures 2, 3, and 4] As was explained in the rejection of **claim 7**, **Mansfield et al.**, and **Macovski et al.**, teach and suggest the ability to substitute "silicon controlled rectifiers", for the transistor switch components in an MRI circuit configuration. [See the rejection of claim 7] Therefore, applicant's claimed limitation is taught and suggested from the teachings of **Van Groningen**, in combination with the teachings of **Mansfield et al.**, or **Macovski et al.** The same reasons for rejection, obviousness, and motivation to combine that apply to **claims 1, 7** also apply to **claim 9**.

34. **Claims 16, 20,** and **26** are **finally** rejected under **35 U.S.C. 103(a)** as being unpatentable over **Van Groningen**, US patent 6,140,873 issued October 31st 2000 with an effective filing date of July 28th 1999 as applied to **claims 1, 10, 18, 23** above; or alternatively in further view of **Vavrek et al.,** US patent 5,311,135 issued May 10th 1994.

35. With respect to **Claim 16, corresponding system claim 20** which depends from **independent claim 18** and **corresponding method claim 26** which depends from **independent claim 23; Van Groningen**, suggests and shows that "the switching assembly comprises: a third switching device" (i.e. a diode such as component 40-i through 40-n; or 42-i through 42-n) coupled in parallel with the first switching device" [See Figure 2] "the third switching device having a conductive state during a first portion of a second pulse of the pulse sequence, the second pulse having a polarity opposite of the first pulse;" [See Figures 2, 3, 4 and col. 5 line 29

through col. 9 line 20. The examiner notes that the current changing from positive to negative is suggestive of a change in polarity] "and a fourth switching device" (i.e. a capacitor such as component 54-i through 54-n; or 52-i through 52-n) "coupled in parallel with the third switching device", [See Figure 2] "the second switching device having a conductive state during a second portion of the second pulse of the pulse sequence, such that the conductive path is provided between the amplifier and the gradient coil assembly during substantially the entire duration of the second pulse." [See Figures 2, 3, 4 and col. 5 line 29 through col. 9 line 20]

36. Additionally **Vavrek et al.,** shows in Figures 3 and 9 an MRI gradient coil switching device circuit, that meets the criteria set forth by applicant. [See Figures 3, 9 and the teachings of the **Vavrek et al.,** references concerning Figures 3 and 9] The examiner notes that the entire **Vavrek et al.,** reference is applicable because the invention of **Vavrek et al.,** is a way to couple and decouple multiple MRI gradient field coils or sets of coils, which must be switched in the course of an MRI pulse sequence, and is one of applicant's main concerns. Additionally, since the **Vavrek et al.,** reference is directed toward enabling and disabling at least two sets of two gradient coils, which must be switched, and the **Van Groningen**, reference is concerned with the effective switching, of the gradient power amplifier which supplies power to the gradient coils of the MRI device, it would have been obvious to one of ordinary skill in the art, at the time that the invention was made, that modifying the switches of the **Vavrek et al.,** reference, to include the switches of **Van Groningen**, is desirable because the switches of **Van Groningen**, preserve the natural efficiency of the low voltage power supply. [See abstract col. 1 line 8 through col. 11 line 17], and assist in reducing and / or eliminate the potential hazard of electrical voltages and

currents that arise from any source in the MRI system, and injuring a patient, which increases the safety of MRI procedures. The same reasons for rejection, obviousness, and motivation to combine, that apply to **claims 1, 10, 18, 23** also apply to **claims 16, 20,** and **26**.

37. **Claims 17, 22,** and **27** are **finally** rejected under **35 U.S.C. 103(a)** as being unpatentable over **Van Groningen**, US patent 6,140,873 issued October 31st 2000 with an effective filing date of July 28th 1999; as applied to **claims 1, 10, 16, 18, 20, 23** and **26** in view of **Vavrek et al.,** US patent 5,311,135 issued May 10th 1994.

38. With respect to **Claim 17, corresponding system claim 22** which depends from **independent claim 18** and **corresponding method claim 27** which depends from **independent method claim 23;** The **Van Groningen**, reference lacks teaching that teaches that "the gradient coil assembly comprises a first gradient coil set, and a second gradient coil set, and that "the switch assembly selectively couples the amplifier to either the first gradient coil set or the second gradient coil set." However, **Van Groningen**, teaches that the gradient amplifier is associated with supplying the power supply of the gradient coil system 3 shown in Figure 1 [See **Van Groningen**, col. 5 line 66 through col. 6 line 1 with Figures 1 and 2] and the **Vavrek et al.,** reference, suggests and shows the limitation that "the gradient coil assembly comprises a first gradient coil set, and a second gradient coil set", and that "the switch assembly selectively couples the amplifier to either the first gradient coil set or the second gradient coil set.". [See **Vavrek et al.,** Figures 3, 9, col. 7 lines 36-64]. The same reasons for rejection, obviousness, and motivation to combine that apply to **claims 1, 10, 16, 18, 20, 23** and **26** also apply to **claims 17, 22,** and **27** and need not be reiterated.

39. **Claim 21** is **finally** rejected under **35 U.S.C. 103(a)** as being unpatentable over **Van Groningen**, US patent 6,140,873 issued October 31st 2000 with an effective filing date of July 28th 1999; in view of **Vavrek et al.,** US patent 5,311,135 issued May 10th 1994 and in further view of alternatively **Macovski et al.**, US patent 5,835,995 issued November 10th 1998, filed October 28th 1996; or **Mansfield et al.**, US patent 4,820,986 issued April 11th 1989.

40. With respect to **Claim 21**, the **Van Groningen**, reference and the **Vavrek et al.,** reference lack directly teaching that "the first switch device and the third switching device each comprises a silicon controlled rectifier." However, the semi-conductor switches in the **Macovski et al.**, and **Mansfield et al.**, references, as taught in the rejection of **claims 7, 14,** and **19**; suggest that silicon controlled rectifiers can be used for each semi-conductor switch. Therefore, it would have been obvious to one of ordinary skill in the art, at the time that the invention was made that the **Van Groningen**, reference can be modified to enable or disable one or more gradient coils, and that each switch could comprise a silicon controlled rectifier. Therefore, the examiner considers the situation of "the first switch device and the third switching device each comprising a silicon controlled rectifier."to be within the scope of the **Van Groningen**, reference. The same reasons for rejection, obviousness, and motivation to combine that apply to **claims 1, 7, 10, 14, 18, 19, 20,** and **23**, also apply to **claim 21.**

41. Applicant's amendment necessitated the new ground(s) of rejection presented in this Office action. Accordingly, **THIS ACTION IS MADE FINAL.** See MPEP § 706.07(a). Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

42. A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the date of this final action.

43. The **prior art made of record** and not relied upon is considered pertinent to applicant's disclosure.

A) **Souza et al.,** US patent 6,144, 205 issued November 7th 2000 filed November 19th 1998.

B) **Schweighofer** US patent 6,034,565 issued March 7th 2000 filed July 21st 1998.

C) **Schweighofer** US patent 6,028,476 issued February 22 2000 filed July 21st 1998.

D) **Ideler** US patent 6,031,422 issued February 29 2000 filed August 4th 1998.

E) **Schweighofer** US patent 6,163,201 issued December 19th 2000 filed March 26th 1998.

F) **Wirth et al.**, US patent 5,270,657 issued December 14th 1993.

G) **Rohan et al.**, US patent 5,684,402 issued November 4th 1997; which shows circuitry for an MRI device with a gradient power supply and an imaging method. The examiner notes that the features amended by applicant are also suggested by this reference.

H) **Rohan et al.**, US patent 5,521,507 issued May 28th 1996 which shows circuitry for an MRI device with a gradient power supply and an imaging method. The examiner notes that the features amended by applicant are also suggested by this reference.

Conclusion

44. Any inquiry concerning this communication or earlier communications from the examiner should be directed to **Tiffany Fetzner** whose telephone number is **(703) 305-0430**. The examiner can normally be reached on Monday-Thursday from 7:00am to 4:30pm., and on alternate Friday's from 7:00am to 3:30pm.

45. If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, **Diego Gutierrez**, can be reached on **(703) 308-3875**. The fax phone number for the organization where this application or proceeding is assigned is (703)305-3432 .

46. Any inquiry of a general nature or relating to the status of this application or proceeding should be directed to the receptionist whose telephone number is (703) 305-0956.

Tiffany A. Fetzner

TAF

August 18, 2003

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